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# Traffic Engineering



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# **TRAFFIC ENGINEERING BRANCH**

**Annual Report**

Division of Highways  
Department of Transportation  
Prepared by: Traffic Studies  
Unit

### ACKNOWLEDGMENTS

The close working relationship between the Traffic Engineering Branch and other branches in the Division of Highways makes it difficult, within the confines of this text, to acknowledge all the members of the Highway "family" who have contributed to traffic engineering efforts of 1986 and other years, but we wish to express our gratitude for their cooperation and assistance.

We would like to take this opportunity to also recognize the cooperation and support of agencies outside the Division of Highways who have helped to make the accomplishments of the Traffic Engineering Branch possible. Some of these are: The Federal Highway Administration; the Governor's Highway Safety Program; the Division of Motor Vehicles, particularly the Traffic Records Section; the Highway Patrol Division; and the UNC Highway Safety Research Center.



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# INTRODUCTION

The Traffic Engineering Branch's accomplishments for 1986 emphasize the diversity of work required to meet the needs of all who use State road facilities.

The work performed is presented by unit, with professional activities listed alone. Activities of the Division Traffic Services Units are also reported separately. Activities for the year are enumerated wherever practical. Such figures, however, often represent only the results of extensive preparation and ground work, factors not easily quantified.

This Annual Report is intended to serve two purposes:

1. To furnish State Highway officials and others, information on the annual work of the Branch.
2. To explain the functions of the Branch to trainees, new employees, and other groups interested in the safe, efficient control of traffic on the streets of North Carolina.

# ORGANIZATION AND RESPONSIBILITIES

The Traffic Engineering Branch, which is staffed to the Assistant State Highway Administrator of the Division of Highways, is responsible for safe and efficient traffic operations on the State Highway System - a system that consists of 12,107 miles of Interstate and rural primary US and NC numbered routes; 59,264 miles of rural secondary routes; and 5,088 miles of urban routes, for a total of 76,459 miles.

Some of the specific duties of the Branch are as follows:

1. Development of policies for the use of pavement markings, signalization, channelization, driveway and street entrances, medians, speed zones, highway routing, and parking regulations.
2. Preparation of geometric and traffic signalization designs to improve the safety and traffic capacity at problem locations, and to establish optimum traffic signal timing.
3. Analysis of types of accidents, accident severity, and locations having high accident frequency, in order to reduce these factors, and relieve traffic congestion.
4. Development and implementation of various traffic safety programs including Federal Highway Safety Programs and Projects as they apply to the state of North Carolina.
5. Maintenance of uniform policies for the traffic engineering work performed by the 14 Division Traffic Services Units.
6. Investigation of requests, complaints, and suggestions for traffic operations improvements.
7. Preparation of traffic control plans to ensure traffic safety for all construction projects.



8. Provision of technical advice and assistance to municipal officials and local governing bodies, upon request. And to provide traffic engineering services to municipalities with populations less than 50,000.

9. Management of funds used for the historical marker program on state roads in cooperation with the Department of Archives and History.

There are 92 positions in the Traffic Engineering Branch as shown on the organization chart on page 6: 49 traffic engineers, 33 engineering technicians, 1 traffic control shop supervisor, 4 electronic technicians, 1 statistical research assistant, and a staff of 7 clerical support personnel.

The Traffic Engineering Branch is organized into two major functions: Field Operations and Technical Operations. These functions are designed to provide a centralized, technical policy-making and design staff (based in Raleigh) to support the statewide field personnel. The following is a brief description of the work done in these areas:

#### TECHNICAL OPERATIONS

TECHNICAL OPERATIONS, is a central design and technical policy making section which provides final plans for construction of improvements, and promotes uniform traffic engineering practices statewide. This section is subdivided into three units as follows:

The Traffic Control Unit prepares traffic control plans for contract construction and maintenance projects involving construction, phasing, construction methods, and traffic control devices to safely and efficiently handle traffic in work zones.

The Signals and Geometrics Unit prepares traffic and geometric design plans for localized improvements and traffic signal designs for contract installation. This unit also coordinates the preparation of agreements and plans for the installation of railroad-grade crossing signals.

The Signing Unit prepares sign design plans (including sign lighting) for contract construction projects, and reviews all requisitions for signs and sign materials installed by Division Traffic Services.



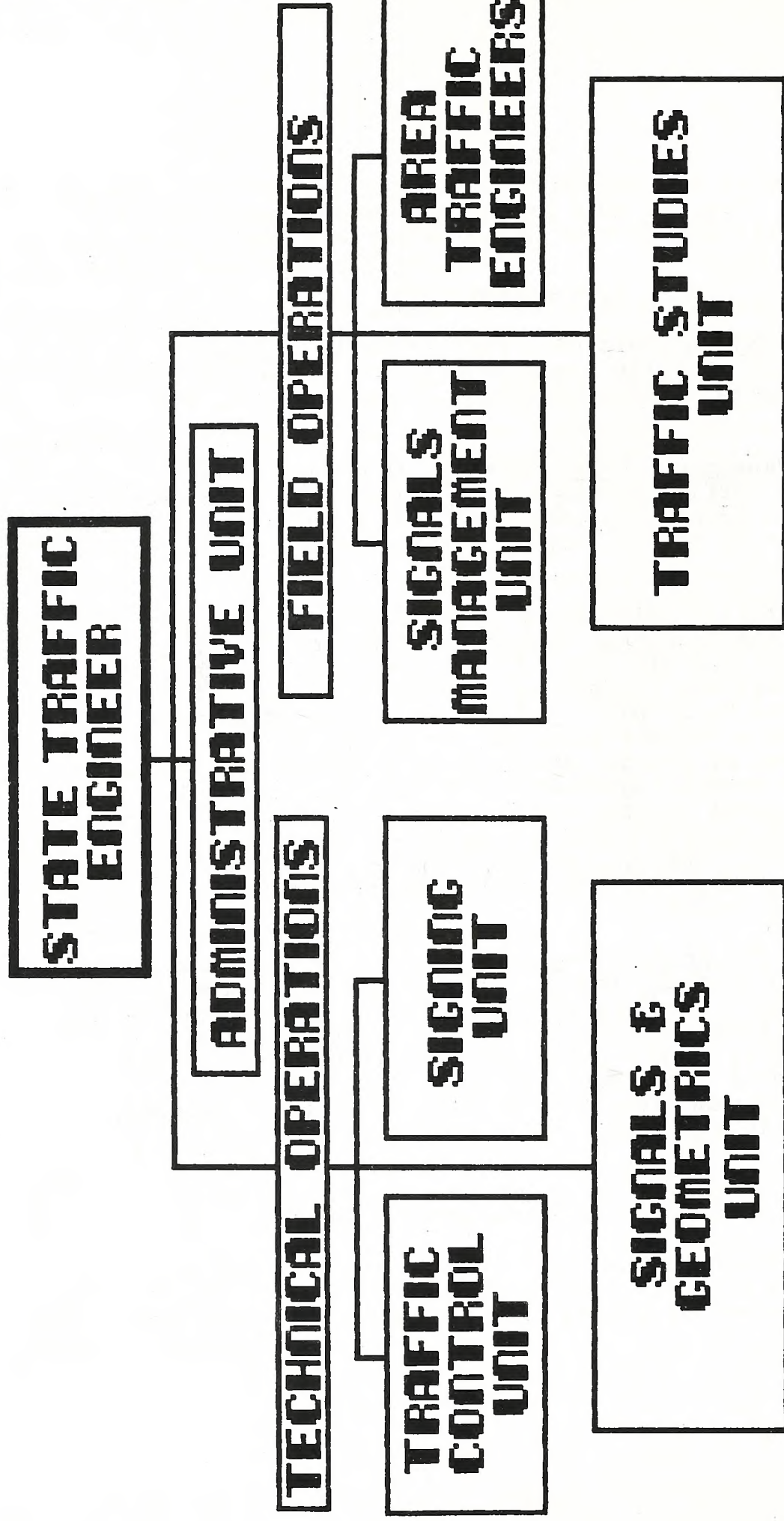
## FIELD OPERATIONS

FIELD OPERATIONS consists of a Raleigh Office Signals Management Unit, Traffic Studies Unit, and three Area Traffic Engineering Units located in Wilson, Winston-Salem, and Asheville.

The Signals Management Unit optimizes the timing and operation of traffic signals and signal systems, and prepares traffic signal specifications. This unit also is involved in the inspection of traffic signal and railroad crossing signal installations.

The Traffic Studies Unit serves as a liaison between the field units, the technical operations function, other branches within the Division of Highways, various state and federal agencies and the public in general. This unit also administers the Municipal Traffic Engineering Assistance Program; reviews roadway plans in the preliminary and advanced stages of design; and reviews driveway permits for major traffic generating locations. Other duties include performing special traffic engineering projects, conducting evaluations on traffic control devices, maintaining the Branch Technical Library, coordinating technical meetings and training activities, and publishing technical materials, including this report.

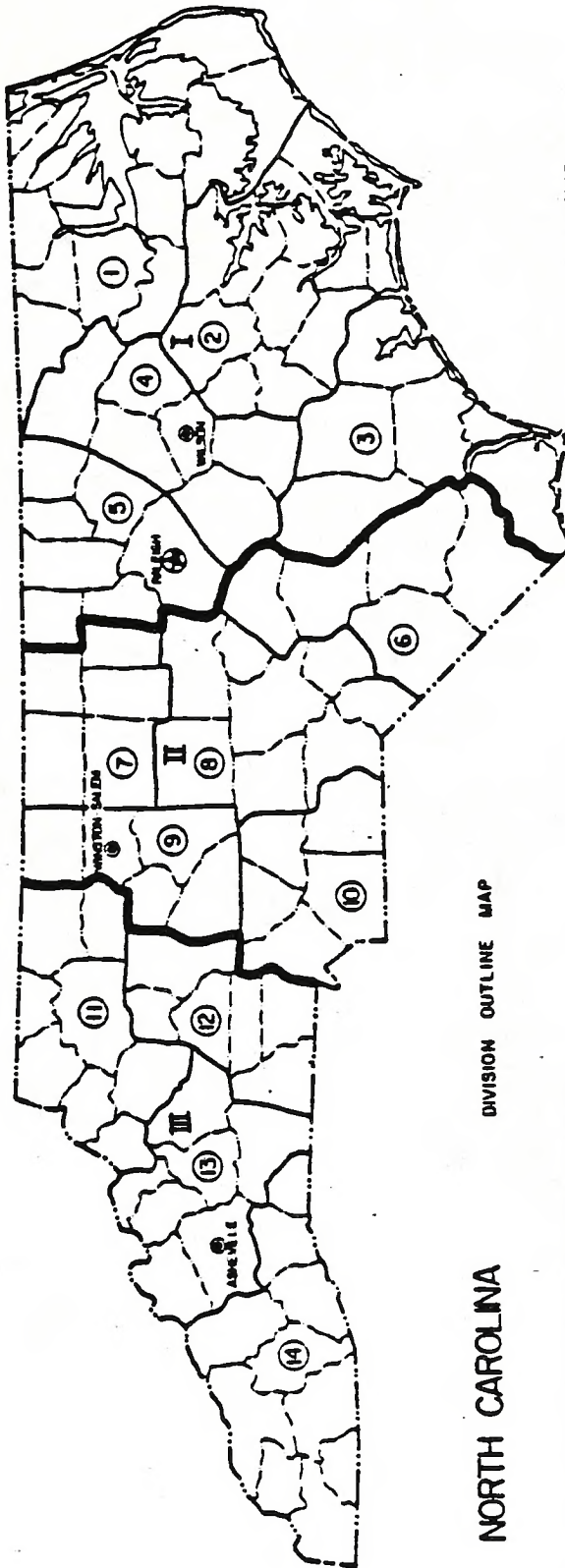
Each Area Traffic Engineering Unit has one or more traffic engineers, who investigate and recommend improvements at locations on the State Highway System which are experiencing traffic operational and safety problems. The three Area Traffic Engineers work closely with the 14 Division Traffic Engineers located throughout the State (see map, page 6, "Area Traffic Engineering Unit Area Assignments"), providing advice and assistance.



**Traffic Engineering Branch  
Organization Chart**

North Carolina Department of Transportation  
Division of Highways

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION  
TRAFFIC ENGINEERING BRANCH  
AREA ASSIGNMENTS



DIVISION OUTLINE MAP

NORTH CAROLINA

**LEGEND**

--- COUNTY LINE  
 --- DIVISION LINE  
 ——— AREA LINE  
 ● AREA OFFICE

AREA	OFFICE	DIVISIONS
I	WILSON	1,2,3,4,5
II	WINSTON-SALEM	6,7,8,9,10
III	ASHEVILLE	11,12,13,14





# ADMINISTRATIVE UNIT

## Purpose

The Administrative Unit is responsible for all clerical and word processing work for the Branch; maintaining personnel and financial records; processing all purchase requisitions; and maintaining equipment and supply inventories.

## Personnel

This Unit consists of one Clerical Supervisor IV, two Word Processor III's and one Typist III.

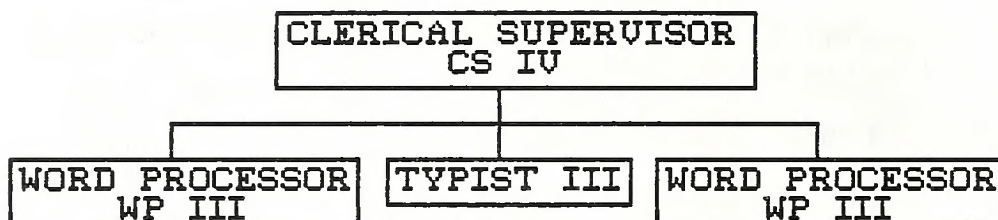
## Organization Changes

None.

## Activities and Accomplishments

This unit performs various administrative duties, such as:

- . . . Typing letters, memoranda and reports.
- . . . Maintaining personnel records; and monitoring and processing salary increments when due.
- . . . Filing and typing all purchase requisitions; and monitoring budget receipts and expenditures.
- . . . Processing all requests for travel and travel advances; and helping employees with moving procedures, motor pool car requests, equipment rentals, workmen's compensation forms, job reports and time cards, and office supplies.
- . . . Handling the Historical Marker Program in conjunction with the Department of Archives and History.
- . . . Serving as receptionist for the branch, with all calls coming through the central office.



ORGANIZATION CHART  
ADMINISTRATIVE UNIT



# Technical Operations



### TECHNICAL OPERATIONS GROUP

Technical Operations, under the direction of the Assistant Manager of Traffic Engineering (Technical Operations), consists of the following units:

1. Traffic Control
2. Signals and Geometrics
3. Signing

These units, located in Raleigh, are responsible for developing final designs, specifications, standards, and engineering estimates for traffic engineering projects and traffic control devices. A detailed description of each unit and their accomplishments during 1986 follows. Activities for each unit are also enumerated for the years 1982-1985. The activity charts show semi-annual quantities as well as annual totals where practical.

# TRAFFIC CONTROL UNIT

## Purpose :

The Traffic Control Unit prepares traffic control plans for roadway construction projects; reviews traffic control plans designed by consultants; designs pavement marking placement; and other special projects.

## Personnel

This unit consists of the following personnel complement:

One Traffic Control Engineer	- (HE III)
Three Traffic Control Project Engineers	- (HE II)
Six Traffic Control Project Design Engineers	- (HE I)
Twelve Traffic Control Design Technicians	- (ET III)
Four Traffic Control Technicians	- (ET II)

## Organization Changes

The unit added 2 project design engineers, 7 traffic control design technicians, and 3 traffic control technicians.

## Activities and Accomplishments

The Traffic Control Unit prepared 157 traffic control projects over the past year, necessitating 59 field investigations and 122 meetings. Also, 72 traffic control plans were revised because of problems developing after letting to contract.

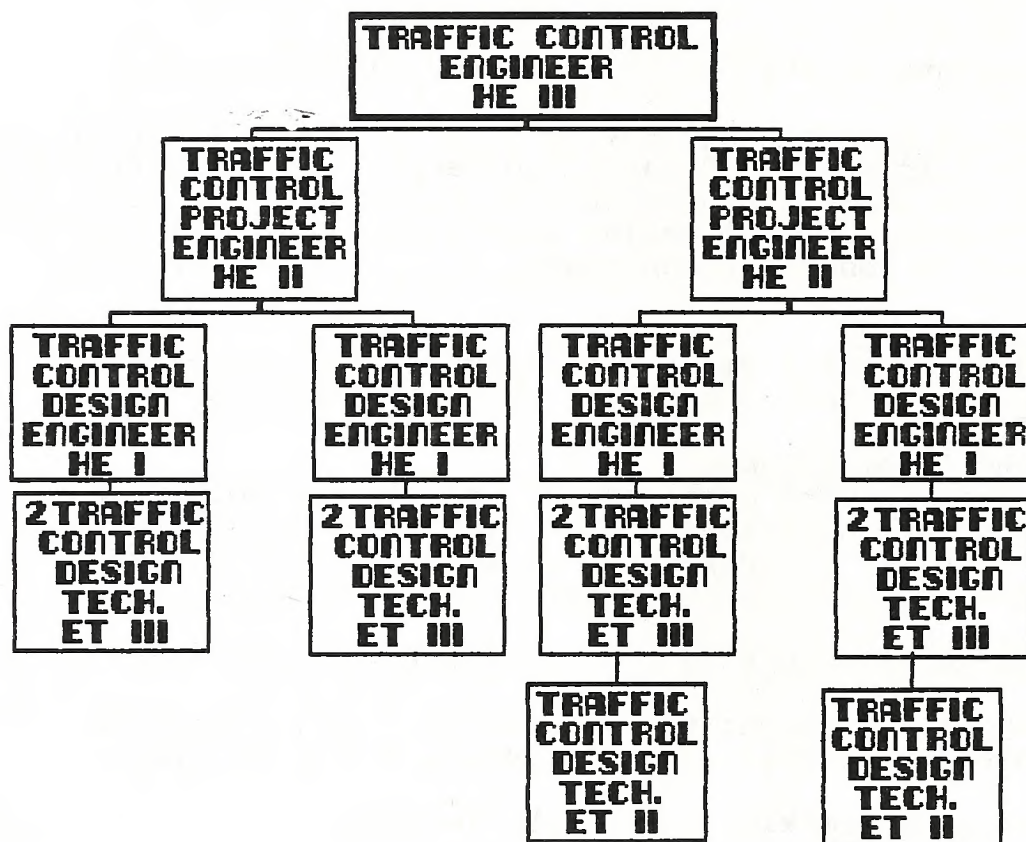
Special assignments completed over the past year included:

. . . Revising the pavement marking manual; and revising the specifications for traffic control devices and procedures.

. . . Developing a tracking system for locating variable message matrix signs.

ACTIVITY DESCRIPTION	1982	1983	1984	1985	1986
1. TCP Design and Final Field Inspection Meetings	( -- )	( -- )	( 150 )	( 103 )	( 98 )
2. Long-life Pavement Plans	( -- )	( -- )	( 24 )	( 22 )	( 22 )
3. Snowplowable Pavement Plans	( -- )	( -- )	( 23 )	( 13 )	( 18 )
4. Preconstruction & Constr. Conferences Attended	( 48 )	( 35 )	( 15 )	( 21 )	( 24 )
5. Highway Construction Plans Reviewed	( 25 )	( 26 )	( 70 )	( 94 )	( 39 )
6. Preparation of Traffic Control Plans for Construction Zones	( 138 )	( 143 )	( 146 )	( 217 )	( 157 )
7. TCP Field Investigations	( 78 )	( 48 )	( 125 )	( 65 )	( 59 )
8. Construction Reviews	( 36 )	( 51 )	( 28 )	( 38 )	( 72 )
9. Pre-bid Conferences	( 3 )	( 2 )	( 2 )	( 5 )	( 7 )





ORGANIZATION CHART  
TRAFFIC CONTROL UNIT

# **SIGNALS AND GEOMETRICS UNIT**

## Purpose:

The Signals and Geometrics Unit prepares plans, estimates, and specifications for the installation of traffic signals; prepares plans for modifying existing highway intersections; and prepares and reviews plans and agreements for the installation of railroad grade crossing signals.

## Personnel:

The unit has a personnel complement of thirteen highway engineers and twelve engineering technicians. These are divided into six squads: five Signals and Geometrics Design Squads and one Railway-Highway Grade Crossing Signals Squad.

## Organization Changes:

Two new squads were added to the unit in 1986.

### SIGNALS AND GEOMETRICS DESIGN SQUADS

#### Activities and Accomplishments:

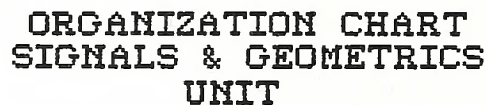
The Signals and Geometrics Design Squads prepare traffic signal plans, and some intersection geometric designs. This work often requires them to do stadia surveys; however, at times, the DOH Locations Unit will make these necessary surveys. The preparation for final designs is coordinated with groups such as Area Traffic Engineers, the Right-of-way Branch, the Utilities Section, the Roadway Design Unit, municipal government officials, and others.

### RAILWAY-HIGHWAY GRADE CROSSING SIGNALS SQUAD

#### Activities and Accomplishments:

This squad coordinates all railway-highway grade crossing signal projects from project selection through authorization for construction. Squad responsibilities include: providing data and recommendations to those responsible for selecting projects; designing layouts of grade crossing signals; arranging for project funding; coordinating the detail design with the railroad companies involved; preparing municipal and railroad company agreements; preparing contract specifications; and reviewing and approving final plans, as well as estimates and materials lists.

In 1986 the Squad advanced 92 projects through their authorization for construction. Some 25 plans were submitted to the railroad and 58 railroad agreements were executed. The squad also made 108 field investigations.



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# SIGNING UNIT

## Purpose:

The Signing Unit designs and develops plans for signs and sign lighting; develops standard sign designs and maintains records on standard signs used by the Division of Highways; and develops and maintains signing standards for the use and placement of highway signs on the public roads and streets.

## Personnel:

The unit consists of the following personnel complement:

One Signing Engineer	-(HE III)
Two Signing Project Engineers	-(HE II)
Three Signing Design Engineers	-(HE I)
Six Signing Design Technicians	-(ET III)
One Signing Technician	-(ET II)

## Organization Changes:

During the past year, the unit acquired two engineering technician positions and one design engineer position. As a result of these new permanent positions, the number of part-time technicians has been reduced from 8 to 2.

## Activities and Accomplishments:

In 1986, the unit acquired personal computers for each employee. These computers have now been fully integrated into the daily work of the unit. All signs and ground-mounted supports are now computer designed; project cost estimates are prepared on the computers; and necessary project correspondence can be prepared.

The unit also acquired one Intergraph CADD work station in the fall, and three employees are now training on it. Employees are currently designing standard drawing cells which will be used to increase the speed of drawing project plans. The impact of the CADD drafting and design system is expected to greatly increase efficiency in the coming year.

PS&E packages were prepared for signing projects while close communications were maintained with field personnel. The Signing Unit prepared plans for 16 signing projects over the past year.

Some of the major tasks completed during the past year are as follows:

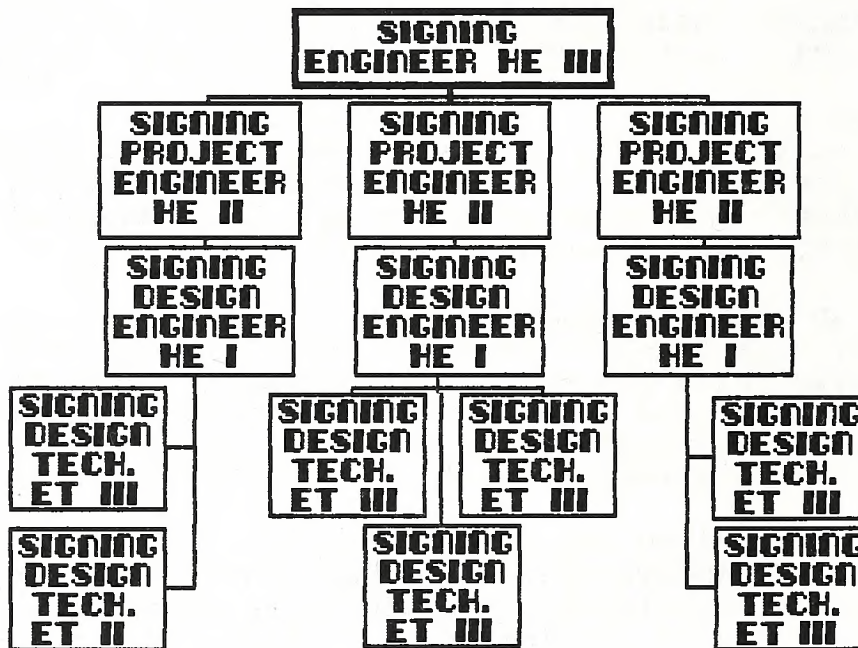
. . . Developed additional microcomputer applications to aid in the process of sign design, support designs and cost estimates.

. . . Maintained computerized data bases for current signing projects and signing plans on file.

. . . Installed several layouts for standard signs on Intergraph CADD hardware.

. . . Developed an updated signing standard for office and field personnel.

. . . Utilized Intergraph CADD work station to draw cross sections for Overhead Structure Line Diagrams.



ORGANIZATION CHART  
SIGNING UNIT

## SIGNING UNIT ACTIVITIES

ACTIVITY DESCRIPTION	1982		1983		1984		1985		1986	
	JAN.	JULY	JAN.	JULY	JAN.	JULY	JAN.	JULY	JAN.	JULY
	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.
	(TOTAL)		(TOTAL)		(TOTAL)		(TOTAL)		(TOTAL)	
1. Requisitions Processed **		( 567)		( 513)		( 441)		( 241)		( 205)
2. Number Signs Designed for Requisition & Others		( 632)		( 403)		( 432)		( 462)		( 731)
3. Number of Supports Designed for Requisitions & Others		( 90)		( 33)		( 57)		( 55)		( 28)
4. Full-Scale Drawings Completed		( 32)		( 41)		( 23)		( 17)		( 5)
5. Full-Scale Drawings Revised or Redrawn		( 6)		( 7)		( 11)		( 5)		( 0)
6. Contract Projects Completed		( 19)		( 18)		( 20)		( 22)		( 16)
7. Contract Projects Incomplete		( 5)		( 6)		( 12)		( 9)		( 26)
8. Signs Sized & Layouts Made for Projects		( 637)		( NA)		( 789)		( 777)		( 411)
9. Number of Overhead Supports Designed		( 27)		( 18)		( 43)		( 45)		( 49)
10. Number of Overhead Lighting Systems Designed		( 24)		( 18)		( 39)		( 40)		( 46)
11. Projects for which Catalog Cuts Approved		( 8)		( 7)		( 7)		( 10)		( 11)
12. Catalog Cut Approval for Sign Lighting		( --)		( --)		( 16)		( 19)		( 12)
13. Contract Cost Estimates Made		( --)		( --)		( 50)		( 58)		( 18)
14. Contract Requisition Preparations		( --)		( --)		( 21)		( 15)		( 11)

\*\*Note: Requisitions for standard signs are no longer processed by the Signing Unit.



# Field Operations



### FIELD OPERATIONS GROUP

Field Operations is under the direction of the Assistant Manager of Traffic Engineering (Field Operations), and consists of the following units:

1. Signals Management
2. Traffic Studies Unit
3. Area Traffic Engineering (3 groups)

These units provide field traffic engineering services throughout the state. In accomplishing their respective duties, the staff is in frequent contact with public officials, citizens, and Division personnel. As a result, they are in an excellent position to promote good public relations and an understanding of the Division of Highways' objectives on the local level.

Activities of the Signals Management Unit and the Field Support and Accident Studies Unit are enumerated for the years 1982-1986. Activities of each Area Traffic Engineering Unit are enumerated for the year 1986.

# SIGNALS MANAGEMENT UNIT

## Purpose

The Signals Management Unit is responsible for the acquisition, application, installation, maintenance and optimization of traffic signal equipment. The unit develops specifications, provides technical support and optimizes signals on the highway system. The Unit also administrates railroad grade-crossing projects.

## Personnel

The Unit consists of the following personnel complement:

1 Signals Management Engineer	-(HE III)
1 Signal Systems Engineer	-(HE II)
1 Signal Equipment Engineer	-(HE II)
1 Assistant Signal Equipment Engineer	-(HE I)
1 Signal Equipment Contract Engineer	-(HE I)
1 Signal Equipment Design Technician	-(ET III)
1 Railway-Highway Grade Crossing Signal Technician	-(ET III)
2 Signal Systems Technicians	-(ET III)
1 Signal Equipment Technician	-(ET II)
1 Traffic Control Shop Supervisor	-(TCSS)
4 Electronic Technicians	-(ELT I)

The Unit is divided into two functional groups: a Signal systems Squad and a Signal Equipment Squad.

## Organizational Changes

Two positions were added to the Signal Equipment Squad: a Signal Equipment Contract Engineer and a Signal Equipment Technician.

## SIGNALS SYSTEMS SQUAD

### Activities and Accomplishments

The Signals Systems Squad's primary emphasis is helping motorists reduce fuel consumption, traffic congestion, and unnecessary delays by optimizing traffic signals. The squad obtains up-to-date traffic volumes, and inventories characteristics and speeds of intersections. This data is then analyzed, and new updated timings are determined. Final implementation is accomplished in concert with the Highway Divisions.

Studies are also conducted to determine if the interconnection of existing isolated signals will reduce vehicle operating costs.

Thirty-three signal retiming projects were active in 1986 of which twenty-five projects were completed. Estimates of the reduction in stops, delays and of completed projects indicates an annual average operating cost savings of \$85,500 per project. The construction



costs per project ranged from \$300 to \$3,000. Studies completed during 1986 are as follows:

Aberdeen	US-1 System
Asheville	US 19-23 BUS System
Black Mountain	CBD System
Brevard	CBD System
Elizabeth City	BUS 17 Bypass, US 158 to SR 1384
Elizabethtown	US 701-NC 87 CBD System
Fayetteville	CBD System West-Side One Way Pair US 401 Bypass, and Morganton Rd. Sys. US 301 Eastern Blvd. at Person St.
Garner	Vandora Springs Rd. System
Gastonia	US 321 One-Way Pair, York-Chester St.
Greenville	Tenth St. System
Hamlet	US 74, Hamlet Ave., 3 Intersections
Henderson	Dabney St. System
Lexington	Lexington CBD System
Raleigh	US 1-401 North, North Blvd. US 70, Glenwood Ave. Crabtree Sys.
RTP	SR 1959 Sys. (Miami Blvd.) SR 1121, Cornwallis Rd. Sys. I-40 at Davis Dr.
Salisbury	CBD System, Main and Innes Sts.
Siler City	US 421 Second St. and First St.
Smithfield	US 70 Market St. Sys., First to Eighth
Thomasville	CBD System, Randolph - Main Sts.
Waynesville	Russ Ave. US 276 from Ingles to Boundry

The Signal Optimization Squad, a group of six contract employees responsible for the retiming of isolated traffic signals, completed the retiming of 444 intersections during 1986. The work resulting in an estimated annual operating cost savings of \$21,370,000. Since the commencement of the optimization project, 649 intersections have been retimed for an annual operating cost savings of \$42,577,000.

#### SIGNAL EQUIPMENT SQUAD

##### Activities and Accomplishments

The Signals Equipment Squad procures, evaluates, stocks and distributes traffic control equipment; provides technical assistance to various agencies; and administers railroad signal construction projects. The Squad also evaluates new equipment.

Additionally, the squad reviews all traffic signal equipment to assure that the proposed equipment can accommodate the developed design. When special traffic signal functions are required, necessary circuitry and schematics are developed.

During the past year, the squad completed the PS&E stage of 2 computerized signal systems for Fayetteville and Asheville, construction is scheduled to begin in early 1986 on both these projects.

The Durham computerized Signal system and the cable project for the Raleigh Computerized Signal System were completed.

The squad also procured the equipment for the Urban Upgrade Program scheduled to begin construction in 1987, and completed the Cape Fear Memorial Bridge variable message sign project.

In the area of railroad signal installations, five (5) grade crossing projects were underway at the end of 1986. fifty-one (51) were completed during 1986 with a total billing of \$1,900,000. Inspections were performed on all 51 completed projects. Construction stake-outs were performed at 6 construction sites at the request of the contractors.

sixty-seven (67) maintenance inspections were performed on railroad crossings. The squad processed \$438,031 in maintenance payments to the railroads.

In addition to the major projects stated above, the squad worked on the following projects and programs:

- . . . Performed 28 inspections of new signal installations and continued to develop policies and procedures for the Traffic Signal Inspection Program for all new installations.

- . . . Prepared designs and schematics for 61 "special functions" required by the Signals and Geometrics Unit.

- . . . Reviewed 340 scratch requisitions for new signal installations and upgrades.

- . . . Completed the power consumption study (conducted in conjunction with CP&L) to determine power usage for typical traffic signal configurations.

- . . . Completed the signalization for the Crabtree Valley Signal System in Raleigh.

- . . . Investigated 28 tort claims and reports.

- . . . Processed 196 signal equipment requisitions.

- . . . Recommended 19 bid evaluations for award.

- . . . Had 1,265 incidents of technical response to Highway Divisions and other agencies.

- . . . Developed 7 estimates for signal construction projects.

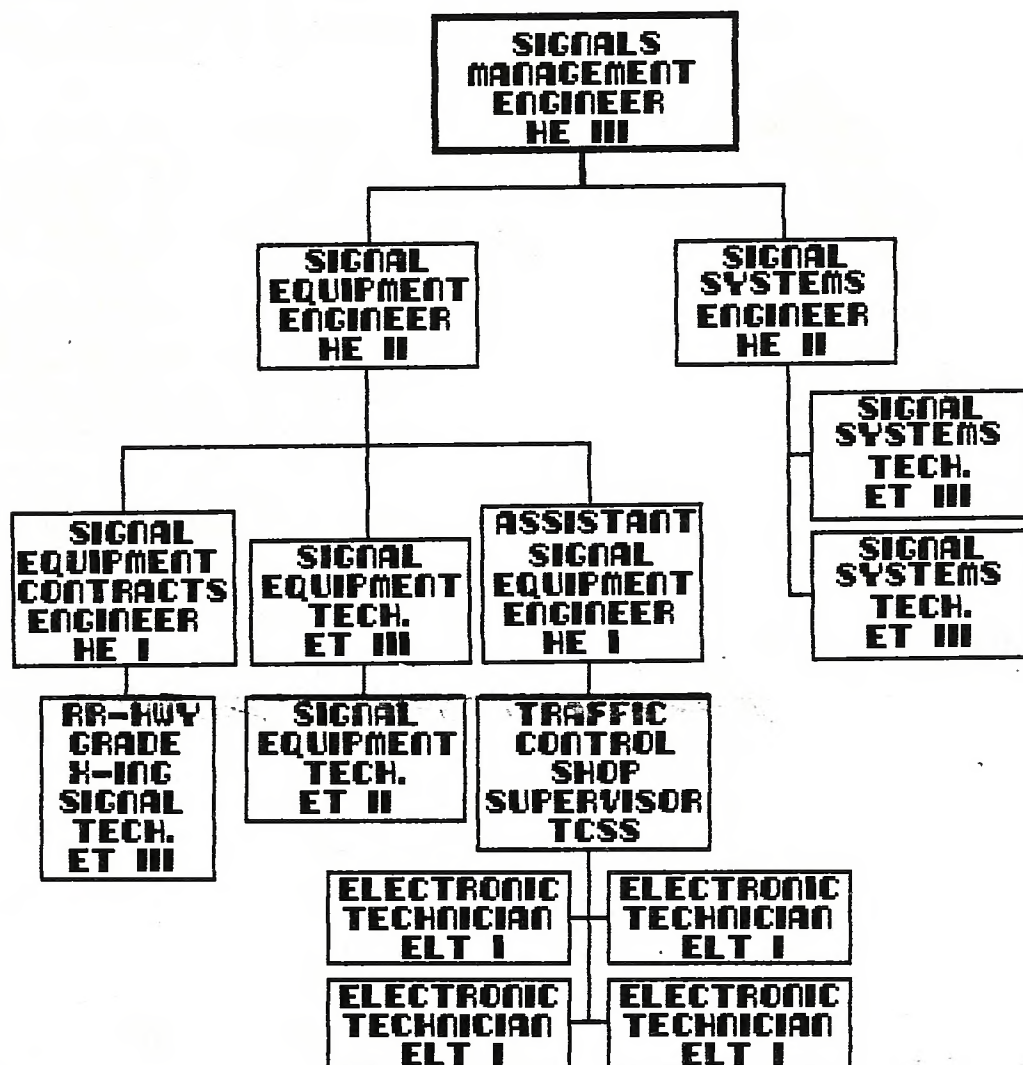
- . . . Processed 138 railroad invoices for payment.

During 1986, the Signal Equipment Squad, at its Central Repair Facility, spent in excess of \$18,300 on replacement parts. An additional \$5,500 was spent on test equipment to better perform repairs.



The following is a list of accomplishments of the Repair Facility:

<u>Equipment Repaired</u>	
Solid State Controllers/Assoc.	603
Electromechanical Controllers/Assoc.	1,304
Accessory Control Equipment	493
Detector Amplifiers	1,103
Test Equipment	12
Cabinets (rewire and repair comp.)	6
Field Repairs in Divisions	12
	-----
Total:	3,533



**ORGANIZATION CHART  
SIGNALS MANAGEMENT UNIT**



# TRAFFIC STUDIES UNIT

## Purpose

The Traffic Studies Unit is responsible for testing and evaluating traffic control and traffic safety devices, new materials and new traffic engineering methods for possible use on the State Highway System; performing special traffic engineering project and programs; reviewing street and highway construction plans for traffic safety and operations problems; and reviewing Special Commercial Driveway Entrance Permit Applications.

This Unit also administers the Municipal Traffic Engineering Assistance Program which provides traffic engineering assistance to those municipalities (under 50,000 pop.) not having a traffic engineer.

This unit is responsible for performing accident studies to identify hazardous locations which have the greatest potential for accident reductions. Through these studies, highway safety improvement needs can be determined, and the effectiveness of installed treatments can be determined.

## Personnel

The Traffic Studies Engineer is responsible for supervising the following major functions: Field Support, Special Projects, Design Review, Municipal Traffic Engineering Assistance, and Accident Studies.

The remainder of the staff is as follows: (1) An Engineering Tech III performs various special projects (2) a Highway Engineer I and an Engineering Tech I does the design review work; (3) Two Highway Engineer IIs are responsible for the Municipal Traffic Engineering program; and (4) The Accident Studies Function is handled by an Accident Studies Engineer, three Engineering Technician IIs, one Statistical Research Technician II and one Clerk-typist.

## Organization Changes

The Municipal Traffic Engineering program was phased out until future funding becomes available.

## SPECIAL PROJECTS

### Activities and Accomplishments

The Special Projects Function includes a variety of engineering studies, investigations, and reports. Normally, these projects fall into one of the following categories: Traffic Control Devices Evaluation, Pavement Marking Projects, and Administrative Staff Engineering Services.

During 1986, the following Special Projects were conducted:

... Conducted evaluations on various traffic control devices.

- ... Administered the statewide Section 205 Pavement Marking Demonstration Programs under the Highway Safety Program. Provided technical advice to field staff.
- ... Coordinated the Annual Traffic Services; prepared the annual report; and prepared quarterly work output reports.
- ... Handled the purchase of microcomputer systems. Provided technical assistance and training for these computers. Handled installation of hardware and software for personal computers, terminals, and high speed printers.
- ... Coordinated computer training program for new employees.
- ... Implemented various computer applications.

### DESIGN REVIEW

#### Activities and Accomplishments

The Design Review staff reviews shopping center driveway plans for safety, capacity, and overall traffic operations.

The efficiency and safety of a street or highway depends largely upon the amount and character of interference of vehicles moving along the roadway (interference meaning vehicles leaving or crossing the road, or standing nearby.) In order to protect the traveling public and to fully utilize the potential of the highway investment, it is necessary to regulate the vehicle movements into and out of roadside developments, thus aiding in minimizing the interference with the traffic stream. Driveway traffic accounts for a large percentage of the interruptions to smooth traffic flow. In light of the above, the Design Review staff is concerned with the special review of driveway connections onto the State Highway System. They review design elements of location, spacing, sight distance, throat width, radii angles, deceleration lanes, and grades. These elements greatly influence the operating characteristics and level of service on adjacent highways.

The Design Review Function is coordinated with Roadway Design Unit, Planning and Research Branch, Area Traffic Engineers and FHWA when special problems arise during the design stages of special commercial permits.

The Design Review Squad did the following in 1986:

... 111 Special Commercial Driveway Permits were reviewed with the Highway Design Branch, Planning and Research Branch, and the Area and Division Traffic Engineers.

... 15 driveway permits were reviewed as Regular Commercials for compliance with the "Manual on Driveway Entrance Regulations."



... 125 roadway project plans were reviewed in conjunction with the Area Traffic Engineers.

#### MUNICIPAL TRAFFIC ENGINEERING ASSISTANCE

##### Activities and Accomplishments

The program was discontinued with the end of federal funding as of September 30, 1986.

#### ACCIDENT STUDIES

##### Activities and Accomplishments

The Accident Studies staff identifies and selects hazardous locations which have the greatest potential for accident reduction. The staff also maintains and updates railroad grade crossing inventory and location maps.

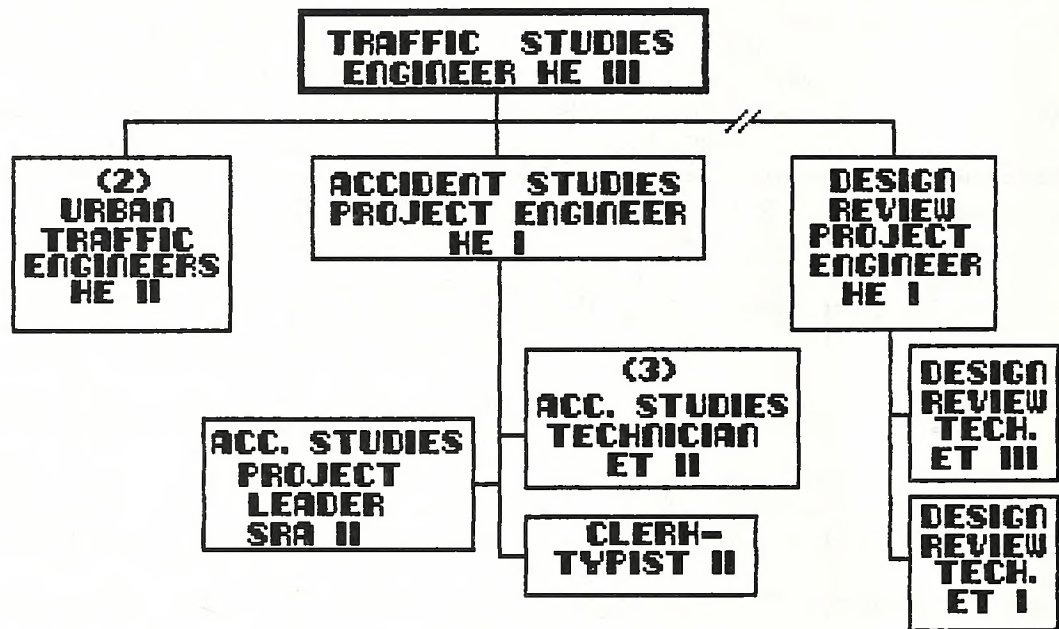
This section accomplished the following in 1986:

- ... Completed and published the 1986 Accident Investigation Program. This program contains 460 intersections, and 40 concentrations and sections, and 65 pedestrian locations.
- ... Completed 1344 routine and special requests for accident data. Of these requests, 19 were for collision diagrams, 40 were for "Before and After" studies and 1285 were for other traffic accident studies.
- ... Continued to update and correct errors in the original American Association of Railroads - Federal Highway Administration Grade Crossing Inventory and maintained the Railroad-Highway Grade Crossing Location maps.
- ... The new 3-digit bridge numbers were added to the location inventory file for 30 counties.
- ... Completed a list of 241 locations at intersections of secondary roads with either primary or secondary roads that had at least 3 stop sign violations.



TRAFFIC STUDIES UNIT

ACTIVITY DESCRIPTION	1982		1983		1984		1985		1986	
	JAN.	JULY	JAN.	JULY	JAN.	JULY	JAN.	JULY	JAN.	JULY
	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.	-JUN	-DEC.
	(TOTAL)		(TOTAL)		(TOTAL)		(TOTAL)		(TOTAL)	
1. Requests Logged IN	259	437	237	357	295	331	306	332	304	270
		696		594		626		638		574
2. Traffic Volumes Requested	283	351	162	298	270	261	339	312	313	658
		634		460		531		651		971
3. Work Orders Processed	60	160	49	68	97	90	74	141	122	178
		220		117		187		215		300
4. Municipal Speed Zone Additions & Deletions	100	105	112	73	78	149	93	108	139	119
		205		185		227		201		258
6. Rural Speed Zone Addition & Deletions	292	500	361	444	346	509	409	438	908	473
		792		805		855		847		1381
8. Other Additions & Deletions	1056	419	752	857	636	710	636	596	770	635
		1475		1609		1346		1232		1405
9. Project Plans Reviewed		25		0		178		162		125
10. Regular Driveway Permit Reviews		21		37		25		46		15
11. Special Driveway Permit		121		130		161		189		11
12. Collision Diagrams Prepared	140	74	133	128	75	128	10	71	2	17
		214		261		203		81		19
13. Before and After Studies Prepared	23	0	30	137	37	40	0	63	29	11
		23		167		87		63		40
14. Rates Calculated for Tentative Safety Program	179	681	810	0	765	0	746	0	324	419
		860		810		765		746		743
15. Other Accident Studies Prepared	412	406	416	524	454	344	554	519	539	746
		818		940		798		1063		1285



**ORGANIZATION CHART  
TRAFFIC STUDIES**

# AREA TRAFFIC ENGINEERING UNITS

## Purpose

The Area Traffic Engineering Units are responsible for investigating and implementing Safety Programs; investigating and processing requests and complaints regarding traffic matters on State Highways; and providing traffic engineering services on a statewide basis through the three Area Traffic Engineering offices (that coordinate with the 14 Division Traffic Engineers). Some of the detailed responsibilities of the Traffic Engineers are:

- . . . Investigating accident locations and recommending treatment to eliminate safety hazards; and investigating fatal traffic accident sites to determine if immediate safety improvement measures are required.
- . . . Formulating safety improvement projects for possible future funding through any available Highway Safety Programs.
- . . . Providing accident data when requested.
- . . . Investigating and reporting information regarding traffic accidents involving roadway safety design features (i.e. breakaway sign supports, guardrail terminal sections, crash attenuators, etc.).
- . . . Providing information regarding FHSA improvement locations, N.C. DOT's Safety Program, etc.

## Personnel

Each of the three Area Traffic Engineering Units is headed by an Area Traffic Engineer with an office located strategically within his area. Each Area Traffic Engineer has a staff of one or more Traffic Engineers, with a total of ten Highway Engineers throughout the State to carry on the necessary field operations. The Traffic Engineers are based either in the Area office or in offices located within the Area. Each Area Traffic Engineer is responsible for the Branch's field operations in approximately one-third of the State.

## Organization Changes:

None.

These three Areas are assigned the 14 Divisions in the following manner:

AREA 1 consists of Divisions 1-5. The main office is located in Wilson. An engineering office is in Durham.

Area 2 consists of Divisions 6-10. The main office is located in Winston-Salem. An engineering office is in Fayetteville.

AREA 3 covers Divisions 11-14 with the main office in Asheville.



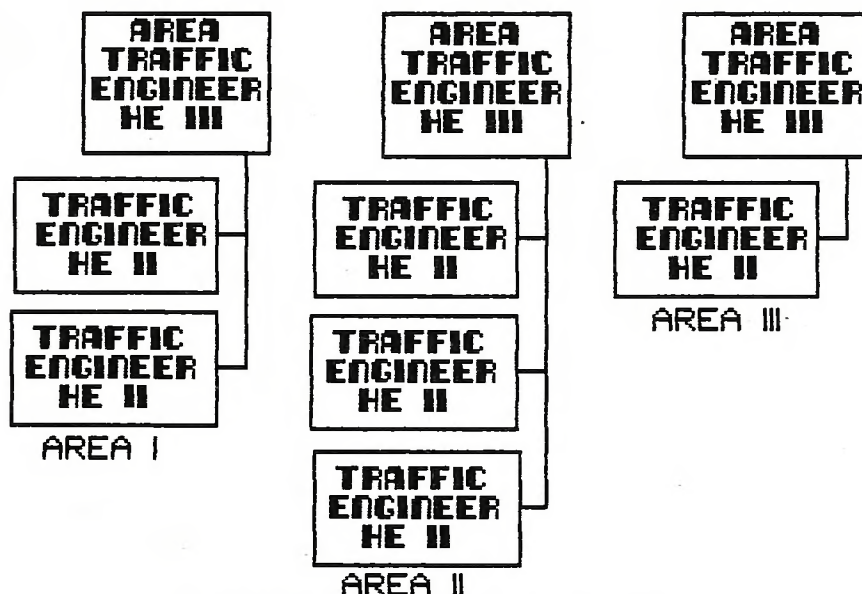
# Area Traffic Engineering Units

ACTIVITY DESCRIPTION	AREA 1			AREA 2			AREA 3		
	JAN.	JULY	TOTAL	JAN.	JULY	TOTAL	JAN.	JULY	TOTAL
	-JUN	-DEC		-JUN	-DEC		-JUN	-DEC	
1. Urban Speed Zones	26	39	65	44	24	68	9	12	21
2. Rural Speed Zones	53	85	138	114	136	250	100	61	161
3. School Investigations (Cross-speed zones, etc.)	16	12	28	13	10	23	8	12	20
4. Intersection Studies	91	123	214	85	117	202	19	29	48
5. Regulatory Signs	40	48	88	9	12	21	10	9	19
6. Guide Sign Investigations	40	40	80	43	101	144	5	8	13
7. Warning Signing Investigations	36	40	76	23	44	67	10	15	25
8. Plan Reviews	52	72	124	30	47	77	12	13	25
9. Crossover Investigations	288	85	373	31	15	46	6	3	9
10. Route Changes	4	6	10	7	2	9	1	1	2
11. Hazardous Location Investigations Non-Safety Program	30	42	72	8	15	23	3	4	7
12. Special Commercial Driveway Permit Review	10	14	24	154	103	257	55	30	85
13. Rural Safety Program Investigations	12	20	32	9	20	29	9	1	10
14. Urban Safety Program Inventory	11	17	28	12	10	22	21	3	24
15. Railroad Crossing Studies	95	15	110	30	32	62	44	11	55
16. Encroachment Contracts	3	4	7	2	3	5	0	0	0
17. Traffic Signal Investigations	126	131	257	60	47	107	68	59	127
18. Pavement Marking Investigatns	97	111	208	15	18	33	7	5	12
19. Other Field Investigations	105	93	198	38	40	78	23	33	56
20. Fatal Accident Locat. Studies	91	124	215	140	168	308	39	45	84
21. Pavement Marking Studies	97	111	208	3	4	7	0	0	0

### Area Traffic Engineering Units

ACTIVITY DESCRIPTION	AREA 1			AREA 2			AREA 3		
	JAN.	JULY	TOTAL	JAN.	JULY	TOTAL	JAN.	JULY	TOTAL
	-JUN	-DEC		-JUN	-DEC		-JUN	-DEC	
22. Channelization	28	32	60	*	*		5	3	8
23. Breakaway Signs, Guardrail, Accidents, etc.	3	2	5	*	*		0	0	0
24. Curve Delineation Studies	10	11	21	*	*		2	2	4
25. Truck Route & Spot Speed Studies	3	2	5	*	*		0	1	1
26. Special Events (foot, bike, boat races, etc.)	4	4	8	*	*		0	0	0

\*Note: A total of 218 separate activities were recorded for items 22-26 for the year in Area 2.



ORGANIZATION CHART  
AREA TRAFFIC ENGINEERING UNITS

# DIVISION TRAFFIC SERVICES UNITS

## Purpose:

The Division Traffic Services Units install and maintain traffic control devices including signs, signals, and pavement markings throughout the state; and work closely with the Traffic Engineering Branch providing technical advice, manpower, and equipment in implementing various programs.

## Personnel

The Division Traffic Services Units are directly staffed to their respective Division Engineer. They are normally composed of: a Division Traffic Engineer, a Traffic Services Supervisor, 8 Sign Erection Crews, 2 Traffic Control Technicians, 1 Traffic Control Technician Supervisor, and 3 Pavement Marking Crews.

## Activities and Accomplishments

During the past year, these units installed and maintained the traffic control devices on State roads. These traffic control devices are divided into three categories: signs, signals, and markings.

**Signs:** Each Division normally has 8 sign erection crews. These crews erect and maintain signs along the State highways in their respective Division.

**Signals:** The approximately 5000 traffic signals on State maintained highways are the responsibility of the Traffic Control Technicians in each Division. These technicians coordinate the installation of new signals and are often found repairing damaged signals at any hour of the day or night.

**Markings:** The Units paint center lines and edge lines on nearly 59,000 miles of paved roadways. Most of the painting is done in the spring, summer and fall months. Approximately 1,000,000 gallons of paint were applied in 1986.

The Division Traffic Engineer administrates and supervises the Traffic Services Unit. Some of his duties are as follows:

- . . . Investigating and responding to all complaints and requests for traffic operations improvements.
- . . . Evaluating all engineering data necessary to arrive at engineering decisions. This data may include traffic counts, accident studies, delay studies, parking studies, speed studies, etc.



- . . . Preparing plans and supervising the installation of minor traffic engineering improvements; coordinating the installation of traffic control devices to assure compliance with plans and specifications; and supervising the timing of all traffic control signals.
- . . . Designing preliminary sketches to alleviate major traffic problems.
- . . . Assisting the District Engineer in the technical review of all regular driveway permits.
- . . . Developing good public relations in dealing with private citizens, various officials, and DOT representatives; and providing city officials with as much technical advise and assistance as possible.
- . . . Reviewing and checking channelization fund work orders and seeing that work is proceeding in an orderly manner.
- . . . Reviewing all traffic engineering functions as they relate to safety and conformity to policies.
- . . . Reviewing construction project plans and providing estimates for needed traffic control devices.

# PROFESSIONAL ACTIVITIES

By encouraging its personnel to participate in professional activities and to work toward professional and educational advancement, the Traffic Engineering Branch hopes to cultivate individual professionalism and thereby develop the full potential of the organization.

During 1986, Traffic Engineering Branch personnel served on the following committees and/or offices:

- AASHTO Traffic Engineering Sub-Committee
- ITE - Student Chapter Guest Speaker
- ITRE Task Force on Traffic Control Devices
- NC DOT - CADD User's Group
- NC DOT-Maintenance Management Task Force
- NCDSSITE- President
- NCSSITE- Instructor
- NCSSITE- Planning Committee
- I-40 Task Force
- City of Fayetteville - Consultant Selection Committee
- Traffic Services Task Force Pavement Marking Subcommittee

Additionally, branch personnel participated in the following professional meetings and conferences:

- AASHTO National Meeting
- CCCASCE Annual Meeting
- Construction Engineers Conference
- Design Engineer's Conference
- ITE Annual Meeting
- ITE National Meeting
- Legislative Hearing on Outdoor Advertising
- Microcomputer User's Group
- National Forum on Work Zone Safety
- NCSSITE Quarterly Meetings
- NCSSITE-Joint Conference on Public Transportation
- SSITE Annual Meeting
- Society of Women Engineer's Meeting
- 3M Sheeting & Marking Conference
- TEB Annual Meeting
- Traffic Services Supervisor's Meeting
- Urban Congestion Conference

The following seminars and training activities were attended:

Accident Studies Workshop  
AMC III  
ATSSA Course for Work Site Supervisors  
Basic Traffic Engineering Workshop  
Corridor Traffic Management for Highway Reconstruction  
Driveway Design Workshop  
Design and Operation of Work Zone Traffic Control Training Workshop  
Engineering 101 Surveying - Wake Tech  
EIT Exam Review  
Elements of Railway Signaling and Control Systems  
Highway Capacity Workshop- ITRE  
Highway Capacity Workshop - FHWA  
Highway Engineering Concepts  
Human Relations Workshop  
Intergraph CADD Training  
ITE Workshop: Signs & Marking  
ITE Joint Transportation Officials Workshop  
LOGO Workshop  
Lotus 1-2-3  
Microcomputer Workshop  
National Highway & Transportation Management Program  
Office Automation Skills I & II  
PE Exam Review  
SITE Impact Workshop  
Traffic Engineering Technician's Workshop  
Traffic Signal Systems Workshop- ITE

#### REGISTERED PROFESSIONAL ENGINEERS

Bivens, N.R.	Mallard, E.F.
Blount, E.B.	Milam, K.E.
Crowe, N.C., Jr.	Payne, B.G.
Deaver, P.G.	Permar, J.F.
Dodge, R.J.	Robertson, D.W.
Eason, G.A.	Sessoms, C.C., Jr.
Gettier, G.L.	Smart, W.D.
Goode, C.B., Jr.	Ward, W.A.
Grigg, G.G., Jr.	Watson, W.J.
Kimley, W.J.	Williams, L.T.
Lynch, J.M.	

#### CERTIFIED ENGINEERING TECHNICIANS

Kellenberger, J.W.



# PROFESSIONAL ORGANIZATION MEMBERSHIPS

NAME	ITE	SSITE	NCDSSITE	NSPE	PENC	REC	ASCE	CCCASCE
Bivens, N.R., P.E.			AF					
Blount, E.B., P.E., RLS *	F	M	M	M	M	M		
Boyles, G.S.			M					
Braswell, W.M.			AF					
Crowe, N.C., Jr., P.E.	M	M	M					
Deaver, P.G., P.E., RLS			AF					
Dodge, R.J., P.E.	F	M	M			M		
Eason, G.A., P.E.		M	M					
Eddins, L.M.			AF					
Gettier, G.L., P.E.			AF	M	M			
Grigg, G.G., Jr., P.E.		AF						
Jeffreys, T.			AF					
Justice, H.A.		M	M					
Kimley, R.J., P.E.								
Lynch, J.M., P.E.	F	M	M				M	M
Oldham, M.W.			AF					
Peoples, T.A.	M	M	M					
Robertson, D.W., P.E. **	A	M	M	M	M		M	M
Rosendahl, J.F.	M	M	M					
Satterwhite, H.L., Jr.			AF					
Sessoms, Jr., P.E.		PAF	AF	M	M			
Shaw, J.W.			AF					
Smart, W.D., P.E.								
Stamp, J.L.		PAF	AF					
Ward, W.A., P.E.		PAF	AF					
Watson, W.J., P.E.	M	M	M					
Webb, D.W.	A	M	M					
White, W.J.							A	
Williams, L.T., P.E.	F	M	M	M	M			
* NSCE also.								
** NCLUC, NCPTA, & SCSA also.								

## Abbreviations for the above organizations:

ASCE - American Society of Civil Engineers  
 CCCASCE - Central Carolina Chapter of the American Society of Civil Engineers  
 ITE - Institute of Transportation Engineers  
 NCDSSITE - North Carolina Division of the Southern Section of Institute of Transportation Engineers  
 NCLUC - North Carolina Land Use Congress  
 NCPTA - North Carolina Public Transportation Association, Inc.  
 NCSE - North Carolina Society of Engineers  
 NSPE - National Society of Professional Engineers  
 PE - Registered Professional Engineer  
 PENC - Professional Engineers of North Carolina  
 REC - Raleigh Engineering Club  
 RLS - Registered Land Surveyor  
 SSITE - Southern Section Institute of Transportation Engineers  
 SCSA - Soil Conservation Society of America

L - Life                      M - Member                      AF - Affilliate  
 F - Fellow                  A - Associate Member              PAF - Professional Affilliate

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